



Washington State Enhanced Hazard Mitigation Plan

Appendix 1 - Analysis of Local Hazard Vulnerability

During the 2010 plan update process, an important element in determining the vulnerability of the state to various natural hazards was to examine how local jurisdictions assessed and categorized their vulnerability to the various hazards, and what hazards were included within the plans. It is also a requirement of federal hazard mitigation planning regulations:

“The (State plan’s) risk assessment shall include ... an overview and analysis of the State’s vulnerability to the hazards ... based on estimates provided in the local risk assessments as well as the State risk assessment.” [CFR 201.4.c.2.ii]

Reviewed for this analysis were the 48 new local hazard mitigation plans available to the State Emergency Management Division (EMD)’s Mitigation and Recovery Section as of January 31, 2010, as well as review of previously approved plans. For those jurisdictions whose plans have expired, the data from the previously approved plans were utilized. It is important to note that all jurisdictions within the state with the exception of Adams and Klickitat Counties were at some level in the planning process as of January 31, 2010 (e.g., awaiting grant award, in the process of selecting consultants to complete their plan, in the update cycle, etc.). Included in these plans were counties, towns, cities, and various types of special purpose districts. A list of all of the plans statewide and their categorization of vulnerability to hazards is detailed in Table 3 of this document. Each of the plans’ risk assessments were reviewed for specific local information that would improve the state plan’s assessment of vulnerability, as well as determination of which jurisdictions were at greatest risk from the nine natural hazards addressed in the plan (see *State Plan Vulnerability Assessment*, below).

The following observations come from the review of the local plans:

- Much of the information contained in the local risk assessments that describe hazards and vulnerability mirrors that which appears in the state plan, though in much less detail.
- Many local plans used and attributed information from the state plan’s risk assessment, or used information from the same sources.
- Local plans in general did not appear to take advantage of information available from local planning departments regarding locations of frequently flooded areas and geologically hazardous areas. These are two of the five critical areas

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identified by state law that all cities, towns, and counties must develop land-use regulations to protect and limit development within.

- A review of the plans demonstrates an inconsistency in the method of determining risk and vulnerability; something which the State has known to be an issue, and something that has been the focus of several training sessions for the local jurisdictions, and the discussion topic of several SHMAT meetings. As a result, a new method of analysis is being utilized within the State's risk assessment this year, and a more in-depth example has been provided within the Risk Assessment section of the Plan contained in Tab 5.

Among the 48 plans reviewed during the time period April 2007 to January 31, 2010 26 were new plans, covering 135 jurisdictions. A breakdown of plan type is as follows:

- 3 Regional Plans
- 8 County plans
- 5 City Plans
- 1 University
- 6 Tribal Plans
- 3 Large Special Purpose Districts

A number of plans are in the review or pre-adoption phase. Collectively, these plans represent more than 99% of the state's population, with only two counties who have elected to not complete mitigation plans – their population equaling less than 40,000 according to 2009 OFM census data.

This analysis of local hazard vulnerability findings of the state plan is limited to the natural hazards listed by the majority of all of the local plans. These hazards are earthquake, flood, severe storms, landslide, volcano, and wildfire. This analysis also briefly examines what other hazards were addressed by the local plans; while federal regulations only require local plans to determine their vulnerability to natural hazards, several plans are also now addressing man-made and technological hazards such as hazardous materials spills and terrorism. Many of the plans have also addressed Climate Change.

State Plan Vulnerability Assessment

The state plan used a variety of criteria, varying by hazard, to determine which counties are most vulnerable to each of nine natural hazards addressed in the plan. These hazards are avalanche, drought, earthquake, flood, landslide, severe storm, tsunami, volcano, and wildland fire. Panels of hazard experts from state and federal government agencies and from academia reviewed and approved the vulnerability criteria used in the state plan. The criteria used to determine most vulnerable counties are in the individual hazard profiles found in the plan's *Risk Assessment*, Tab 5.

A determination of most vulnerable to a specific hazard only means that a group of counties is at greater risk to a particular hazard than the other counties according to the

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state plan criteria. For example, the criteria determined that 12 counties are most vulnerable to flooding. That is not to say that the remaining 27 counties are not vulnerable to the flood hazard – each of the state’s 39 counties have received at least three Presidential Disaster Declaration for flooding since 1956 – but the state plan’s criteria considered their vulnerability to be less significant.

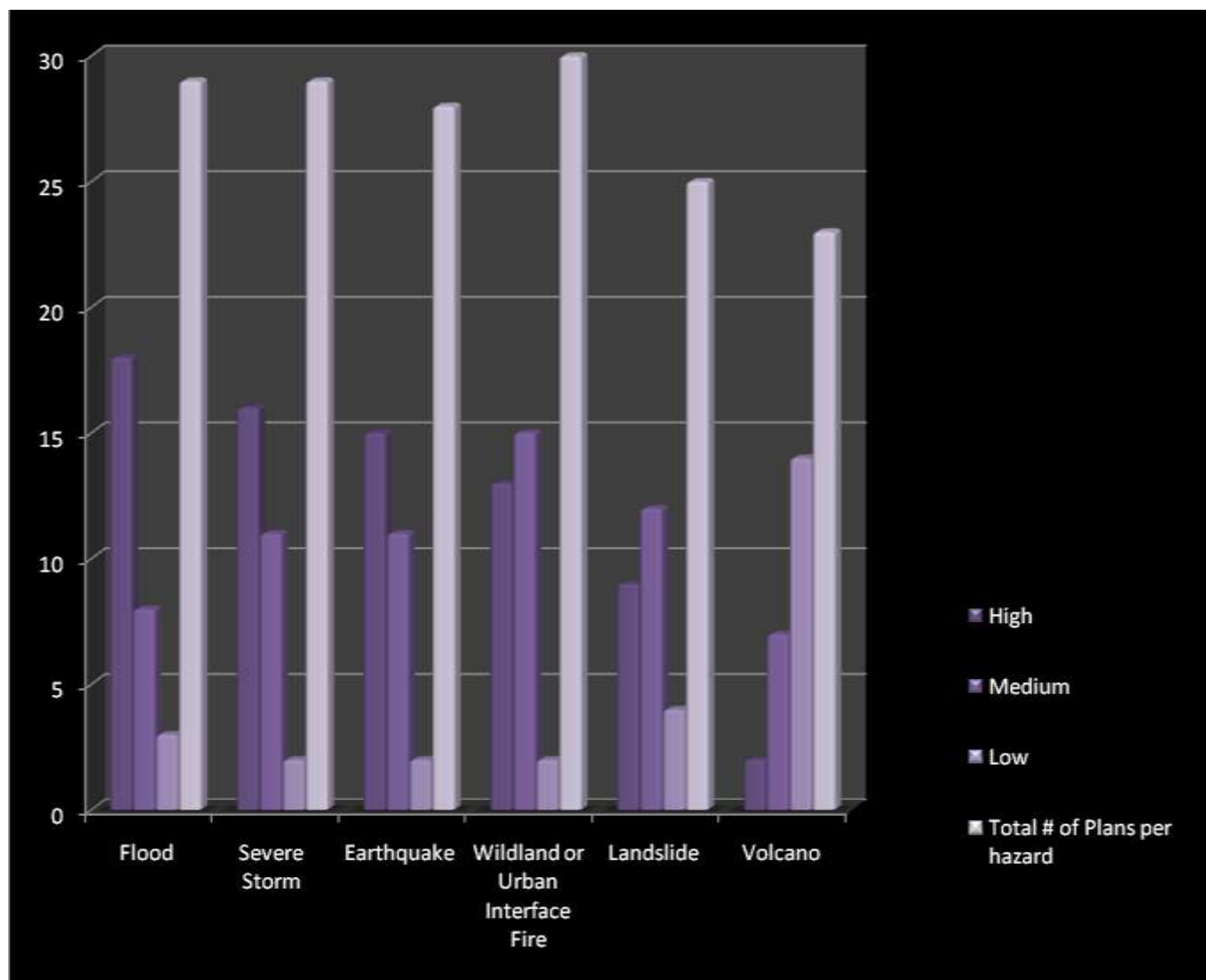
Local Plan Hazard Vulnerability Assessment

During this plan update cycle encompassing the time period April 2007 through January 2010, many of the updated plans have become countywide or regional plans, rather than individual local plans. Therefore, during this analysis portion, the focus will be on the over-all county plans and not the specific city plans, as the majority of all of the larger cities are incorporated into a county or regional plan. For those jurisdictions who are still in the update cycle, unless the plan was approved prior to January 31, 2010, the information from the previous plan editions have been utilized within the following analysis.

Local plans use a variety of methodology to categorize or rate their vulnerability to hazards. Most rated hazards through a three-tier, *high – medium or moderate – low* vulnerability system. Some methodologies were simple, using only probability of future occurrence, sometimes in combination with projected loss estimates, while others used a wide variety of social and economic factors along with probability of future occurrence. A few jurisdictions rated hazards using a numerical priority scale. Whatever method utilized, there was little consistency between the jurisdictions in performing this analysis.

The hazards of greatest concern to local jurisdictions that developed hazard mitigation plans are (in order of concern): flood, severe storms and earthquake. Severe storms and flooding are concerns because of their frequency of occurrence and propensity to cause damage; when plans determined vulnerability to one or more severe storm type, high wind storms and winter storms were listed most frequently. Earthquake is a concern because of the significant amount of damage it can cause.

Hazards of Greatest Concern



Hazards of medium concern are wildfire/urban fire and landslides/earth movement. While 23 jurisdictions listed Volcano as a hazard of concern, 14 ranked the hazard with a “Low” level of risk, with 7 “Medium” and two counties – Whatcom and Lewis, ranked the hazard with a “High” level of risk.

Hazards of lesser concern are tsunami and volcanic eruption, primarily because their probability of occurrence is very low. Only eight counties of the 30 county plans reviewed ranked Tsunami/Seiche. The counties of Grays Harbor, Island and Jefferson ranked Tsunami/Seiche with a “High” level of risk, while King, Kitsap and Pacific ranked the hazard with a “Medium” level of risk.

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Overall, the combined vulnerability rankings of the local plans is similar to the ratings made in the state's plan, which determined earthquake, flood, severe storm, and wildland fire to be the natural hazards of greatest concern.

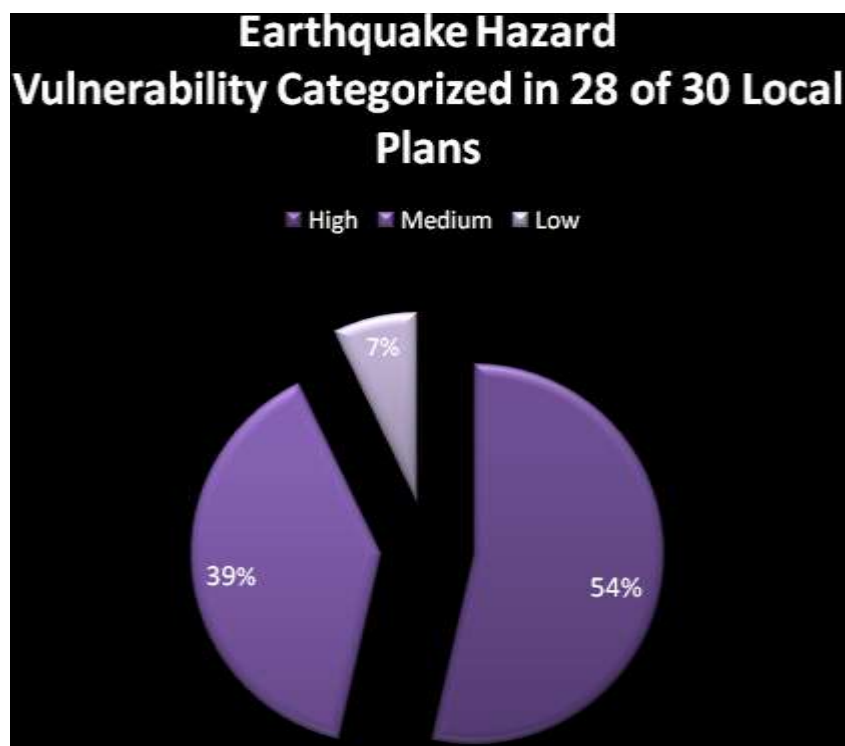
The EMD again this year attempted to develop a new methodology to determine vulnerability to the specific hazards which met the needs of all hazards and had concurrence of the SHMAT. While previous editions of the risk analysis have utilized a procedure somewhat similar to one developed by the British Columbia Provincial Emergency Preparedness office to rate Washington's vulnerability to nine natural hazards, it has been difficult to gain consensus by all of the SHMAT on a method which can be applied for all hazards. Therefore, this year we again embarked upon the mission of developing a universal methodology which considers a variety of factors including: deaths and injuries, property damage, and impacts to the environment, economic and social fabric of affected communities, and the likelihood of occurrence. Once developed, the risk assessment was sent out to approximately 25 planners, subject matter experts and private industry consultants to gain consensus. The assessment was felt by the majority to meet the needs of both the state and locals in conducting risk assessment, and was the method selected in determining risk rankings for the 2010 plan update edition. The actual risk analysis is incorporated within the Risk Assessment, Tab 5. It is hoped that local jurisdictions will utilize a similar method in future editions of their plan updates.

The information on the following pages is a comparative analysis of the local jurisdictions' determination of their vulnerability to the hazards of greatest concern, versus the state's determined of their vulnerability to those same hazards. Table 1 at the end of the section is a recap of the local plans' vulnerability to those various hazards, and is the supporting information for the following analysis. As many of the new plans reviewed since the last state plan are now countywide or regional plans, the focus of this analysis is on county plans rather than a combination of county and city plans. Most of the larger cities have been incorporated into the various county plans, and it was felt that the analysis would be more focused if only county plans were reviewed. In instances where no new approved plan is in place, the information from the previous plan editions was utilized. This factor will dramatically change during the next plan update as there are several countywide plans currently in the update process; several current at FEMA for review, and several new plans in the development phase.

Hazard-Specific Analysis

Earthquake:

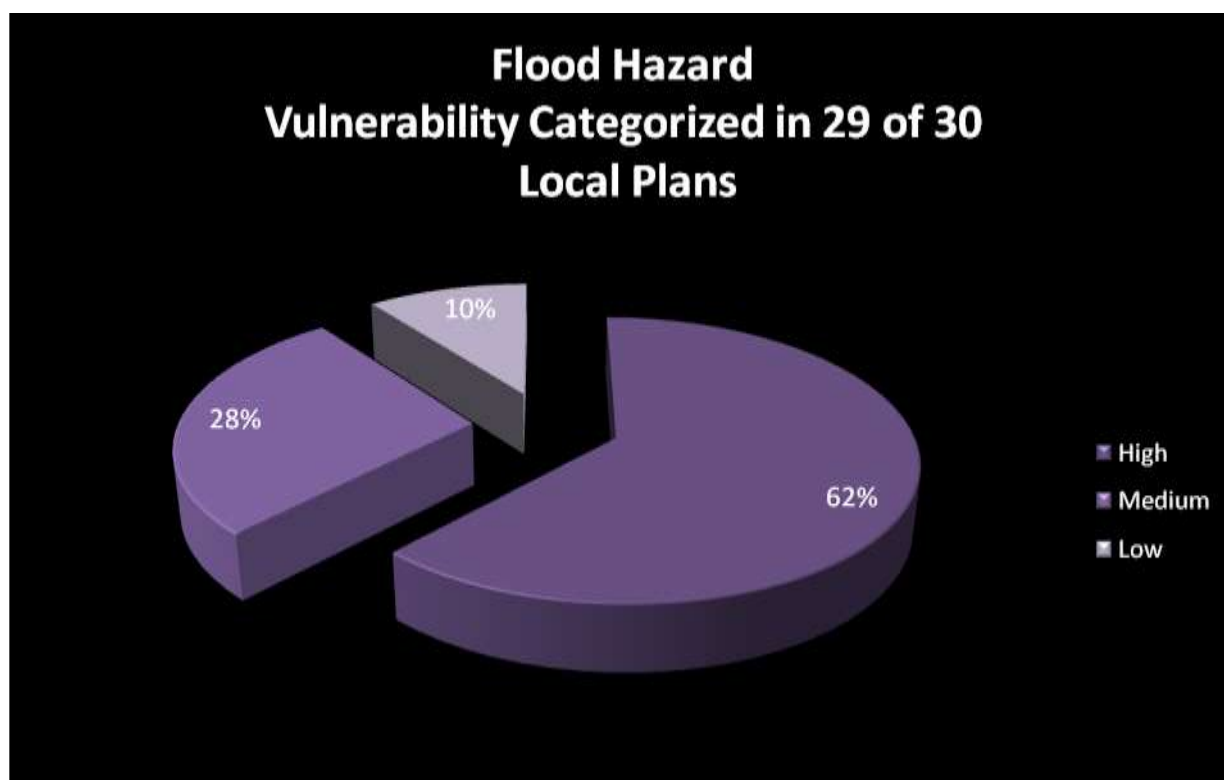
Twenty-eight of the 30 local plans listed earthquake as a hazard that would affect the local jurisdictions, with 15 rating their vulnerability as high. The state plan lists 28 counties as being most vulnerable to the earthquake hazard, based on projected annualized losses and a number of socio-economic factors.



The state plan's categorization of most vulnerable jurisdictions corresponds well with how local jurisdictions view their vulnerability to the earthquake hazard. The only apparent differences were that Okanogan and Stevens Counties listed their vulnerability as High, while Pend Oreille listed their vulnerability as Medium. The State's plan does not categorize these counties as being most at risk and vulnerable.

Flood:

Twenty-nine of the 30 local plans listed flood as a hazard that would affect their local jurisdictions, with 18 of the 29 rating their vulnerability to this hazard as high. The state plan lists 14 counties as being most vulnerable to the flood hazard, based on a scoring system that considered frequency of major flooding resulting in a disaster declaration since 1956, size of the floodplain in the county, and measures of the built environment in the floodplain.



The plans of seven counties not considered as most vulnerable to flooding by the state plan – Benton, Chelan, Clallam, Douglas, Ferry, Kitsap and Island – consider their vulnerability to be high, primarily based on likelihood of future occurrence. For example:

- Benton County (2004 plan) based its high rating on the likelihood of a flood occurring within the five-year life of its plan; the state plan shows that floods causing major damage occur there about every six years, based on previous flood events.

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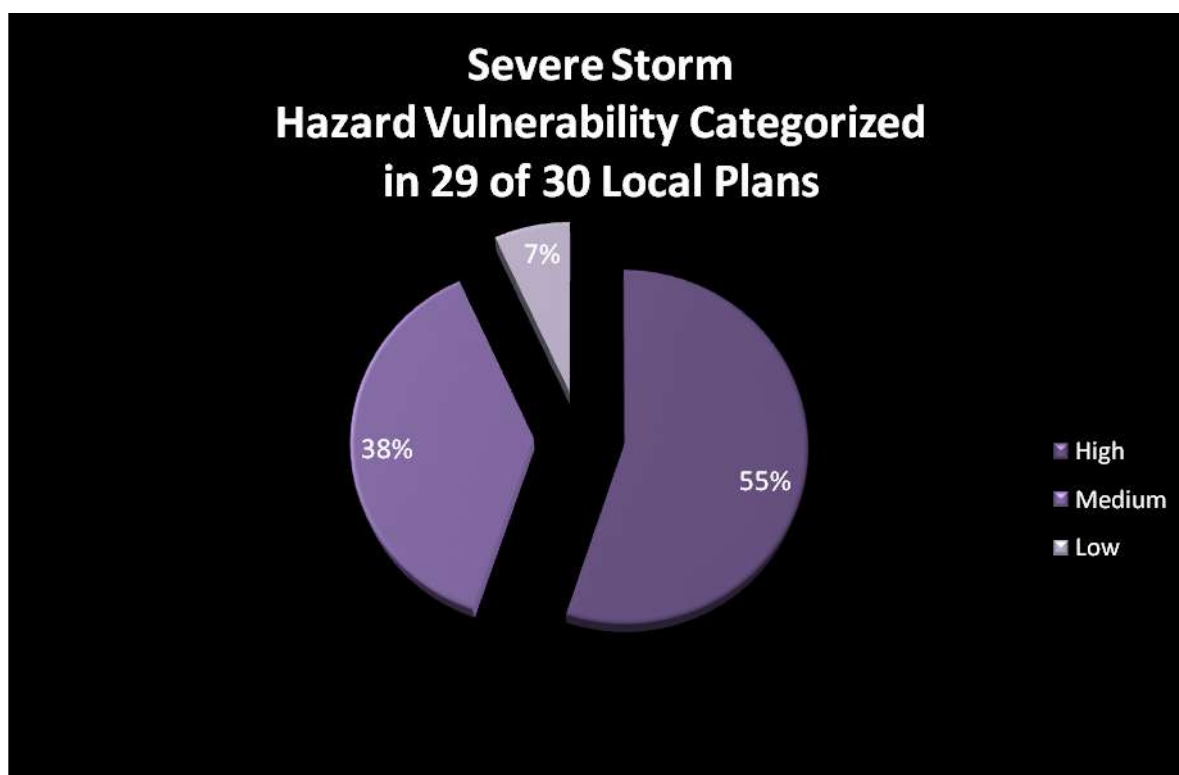
- Kitsap County (2004 plan) used a 25-year threshold; the state plan shows major, damaging flooding occurring every seven years there. The state plan's scoring methodology gave the greatest number of points for major flooding that occurs every three years or less, on average.

Clark (2004 plan), Pierce (Region 5 - 2008 Plan) and Pacific (in FEMA Review) Counties considers their flooding vulnerability to be a medium, while by state's assessment, it is high.

Most of these plans also addressed flooding occurring on specific local rivers and streams.

Severe Storm:

Twenty-nine of the local plans listed severe storms as a hazard that would affect their local jurisdictions. While several plans categorized various severe storm types (e.g., tornado, hail, thunderstorms, etc.) high winds and winter storm (or snow) were listed most frequently.



The state plan lists 23 counties as being most vulnerable to high winds based on their vulnerability to specific meteorological conditions and experiencing a damaging high wind event at least once every year, on average. The state plan lists 19 counties as

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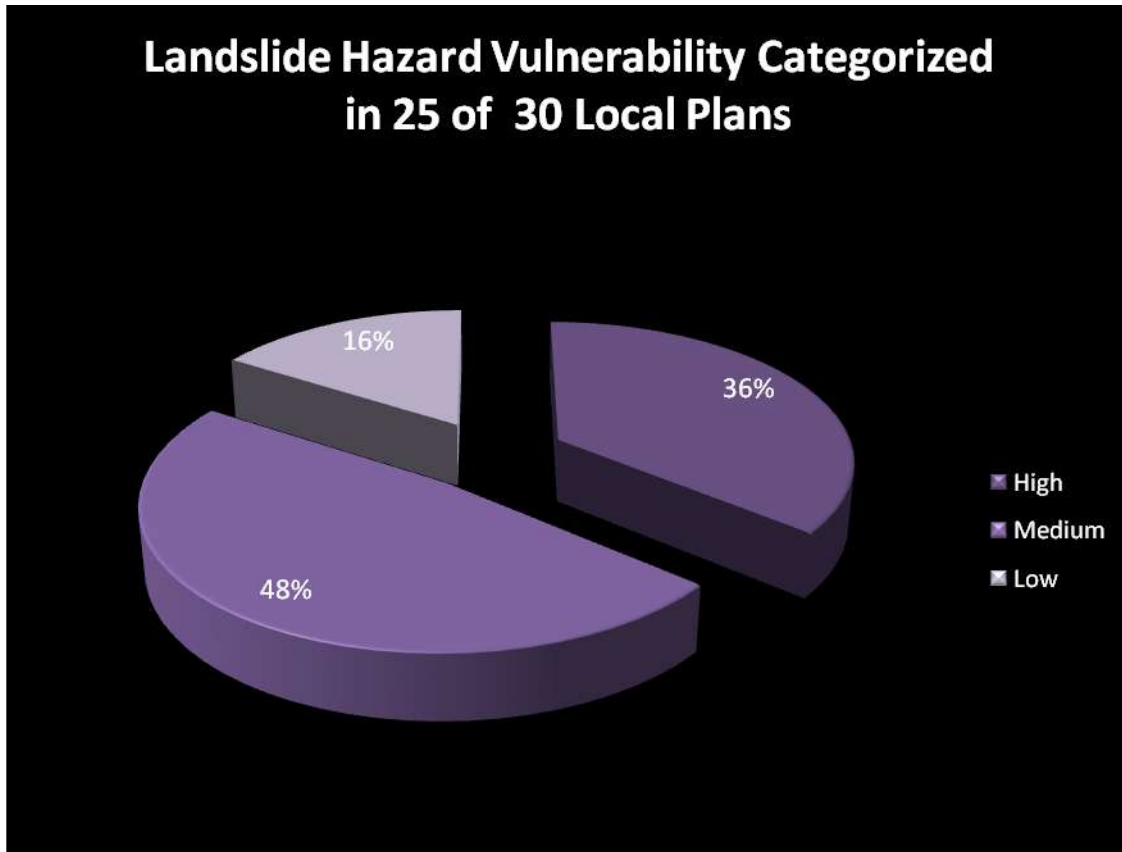
being most vulnerable to winter storms based on their vulnerability to specific meteorological conditions and experiencing a damaging winter storm event at least once every two years, on average.

Of the 30 plans reviewed, nearly all listed severe storm, or high winds or winter storm, as hazard(s) to which their jurisdictions were at high, medium or moderate vulnerability. Only five county plans differed substantially from the state plan in terms of categorizing vulnerability to severe storms, or high winds or winter storms.

- The state plan did not determine Ferry and Whitman Counties among those most vulnerable to severe storms. Ferry County identified severe storms as a key hazard in its plan because cross-county roads and highways are vulnerable to damage from them and there is a high likelihood of occurrence.
- Pend Oreille County based its high vulnerability to winter storms on the state plan's determination that the county was among those most vulnerable to blizzards, which combine heavy snow fall with high winds; the state plan did not categorize this county as most vulnerable to winter storms (see Tab 7.1.6. pages 11 and 12 for definitions of these events).
- Pierce County based its low vulnerability rating on temperate climate conditions, types of storms to strike the county, and limited previous occurrences; the state plan rated the county as most vulnerable to both high winds and winter storms.
- Whatcom County did not address the issue of severe storm within their plan, while the state found their vulnerability to both winter storms and high winds to be high.

Landslide:

Twenty-five of the 30 local plans listed landslide, or some sort of ground movement such as subsidence, as a hazard of concern; nine local plans rated their vulnerability to landslide as high, 12 local plans rated their vulnerability as medium or moderate, and 4 rated their vulnerability as low.



The state plan listed 30 counties as most vulnerable to landslides, noting that part of the jurisdictions have one or more of the following areas prone to landslides:

- Shorelines of the Pacific Coast, Puget Sound and Hood Canal.
- Shorelines of Lake Roosevelt and the Columbia River Gorge.
- Slopes of the Blue, Cascade, and Olympic mountain ranges.
- Corridors of Interstate 5 and U.S. Highway 101.

Five county plans differed significantly from the state plan in their analysis of the landslide hazard; primarily, the county plans state that landslides threatened few people or structures.

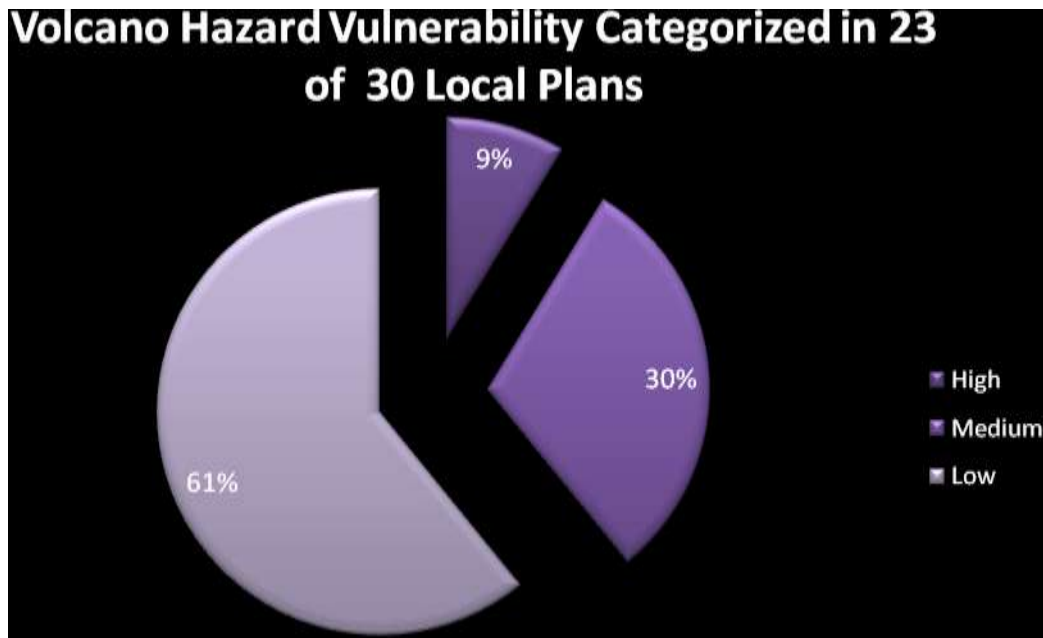
- Walla Walla County did not list landslide as among the five hazards their plans addresses; their plans indicated that landslide posed little risk to people and property in their jurisdictions.
- Ferry County listed landslide as one of four key hazards, but determined that the likelihood of future occurrence and potential impact were low, while noting that landslides have impacted State Routes 20 and 21, key transportation corridors, in the past.

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- Grays Harbor County ranked its vulnerability to landslide lower than several other hazards because it threatens few people or structures; the county's plan did note that landslides do threaten the three major highways that traverse the county, US Highways 8, 12 and 101.
- Pierce County rated its vulnerability to landslides as low based on limited exposure of people and property to vulnerable slopes or waterside terrain; the plan did note that development is increasingly encroaching on steep slopes throughout the county, however.

Volcano:

Twenty-three of the 30 local plans addressed the volcano hazard in some fashion. Two counties indicated that their vulnerability to the volcano hazard is high, seven categorized their vulnerability as medium or moderate, and 14 categorized their vulnerability as low.



The state plan listed 14 counties as most vulnerable to lahars from five volcanoes in Washington and one in Oregon. The state plan based its evaluation of most vulnerable jurisdictions solely on the impact of lahars, as they pose a greater risk to life and property than any other volcanic hazard, according to U.S. Geological Survey hazard reports. Although the state plan did not consider ash fall as part of its risk assessment, Washington State Hazard Mitigation Plan

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the May 18, 1980 eruption of Mount St. Helens showed ash fall can affect human health, damage infrastructure, and have a temporary but significant and costly impact on the economy of affected areas.

Examined were eight county plans to analyze the differences in vulnerability as compared to the state plan.

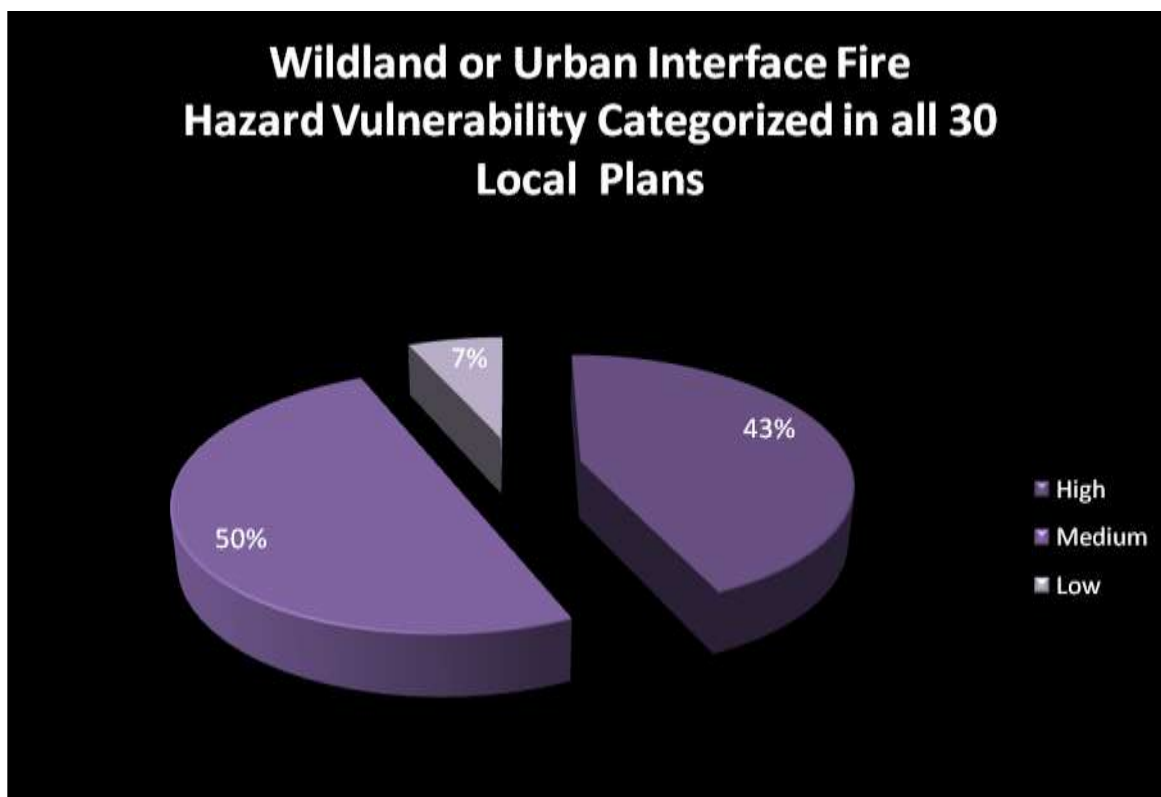
- The state plan categorized Clark, King, Pierce, Snohomish, and Thurston counties as most vulnerable because of lahar inundation zones. These counties considered their vulnerability low because other hazards pose a greater risk primarily due to frequency of occurrence and potential impact on people and property.
- The plans of Franklin, Grays Harbor, and Yakima counties considered their jurisdictions at high, medium or moderate vulnerability because of ash fall; as mentioned above, the state plan did not consider ash fall when determining which counties are most vulnerable to the volcano hazard. Yakima County noted in its plan that ash fall from the May 18, 1980 eruption of Mount St. Helens caused complete darkness in the county; it was one of the counties most significantly impacted by the eruption.

Most interesting was the medium vulnerability rating in the Grays Harbor County plan. While prevailing winds nearly always would carry ash fall east away from this county, its vulnerability determination appears based on the May 25, 1980 ash fall from Mount St. Helens. The county's plan stated this event deposited from one-quarter to three-quarters of an inch of ash in the east-county area leading to power outages, hazardous travel conditions, and stranded tourists.

Wildland Fire:

All 30 local plans addressed some form of fire hazard, either Wildland or Urban Interface, or both, with 13 indicating their vulnerability was high, 15 indicating their vulnerability was medium or moderate, and two indicating their vulnerability was low.

The state plan lists 28 counties as being most vulnerable to the hazard, based on findings by the Washington Department of Natural Resources categorizing 199 communities / zip codes within these counties as being at high-risk to a wildland / urban interface fire. The department developed the list of communities in conjunction with its federal and local partners based on national criteria (NFPA 299 Standard for Protection of Life and Property from Wildfire, 1997) that included fire behavior potential, fire protection capability, and risk to social, cultural and community resources. The list of at-risk communities was originally published in the Federal Register on August 17, 2001 and updated in a DNR progress report in 2004.



Examined were three county plans to analyze the difference in hazard categorization with the state plan.

- Douglas County, one of four not considered most vulnerable to the hazard by the state plan, rated the wildland fire hazard high in its plan. The plan states the probability of occurrence of wildfire is high, with a frequency of once every five years, but that it is not a natural hazard “most prevalent” in the county without giving further reasoning. The plan stated the county frequently experiences smoke that drifts in from large fires in neighboring counties.
- Franklin County rated its vulnerability as medium or moderate because of its dry climate and 85 percent of its land is agricultural and vulnerable to fire.
- Walla Walla County rated its vulnerability as medium or moderate based on a high probability of occurrence in the next 25 years but noted limited exposure of people, property and economy to the hazard.

Other Hazards:

The local plans also addressed three other natural hazards listed in the state plan and not addressed above – avalanche, drought, and tsunami. Only four of the 30 local plans categorized their vulnerability to avalanche, with Chelan County (2005 Plan) listing vulnerability at high, primarily due to road closures; Pend Oreille, Okanogan and

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King County's plan listing vulnerability medium. For King County, this rating is primarily due to the avalanche threat to Interstate 90 at Snoqualmie Pass, as the freeway is the state's primary west-east transportation corridor.

Sixteen plans discussed vulnerability to drought; these plans primarily were from jurisdictions with a significant agricultural industry such as counties in Eastern Washington that are hurt when water supplies are limited, or areas with densely wooded areas, such as Mason, Thurston, Clallam, King and Kitsap Counties .

Eleven plans addressed tsunami; with four plans – Grays Harbor, Island, Jefferson, and Whatcom Counties– categorizing their vulnerability as high. Kitsap, King and Pacific Counties listed their vulnerability as medium. Five jurisdictions listed their threat to Tsunami/Seiche as low, Mason, Pierce, Skagit, Snohomish and Wahkiakum Counties.

Man-Made, Technological and other Hazards:

Many of the local plans have also addressed a significant number of man-made or technological hazards, even though, according to federal regulations on hazard mitigation planning, neither state or local plans were required to address these hazards [CFR 201.4(c)(2)(i), 201.6(c)(2)(i)].

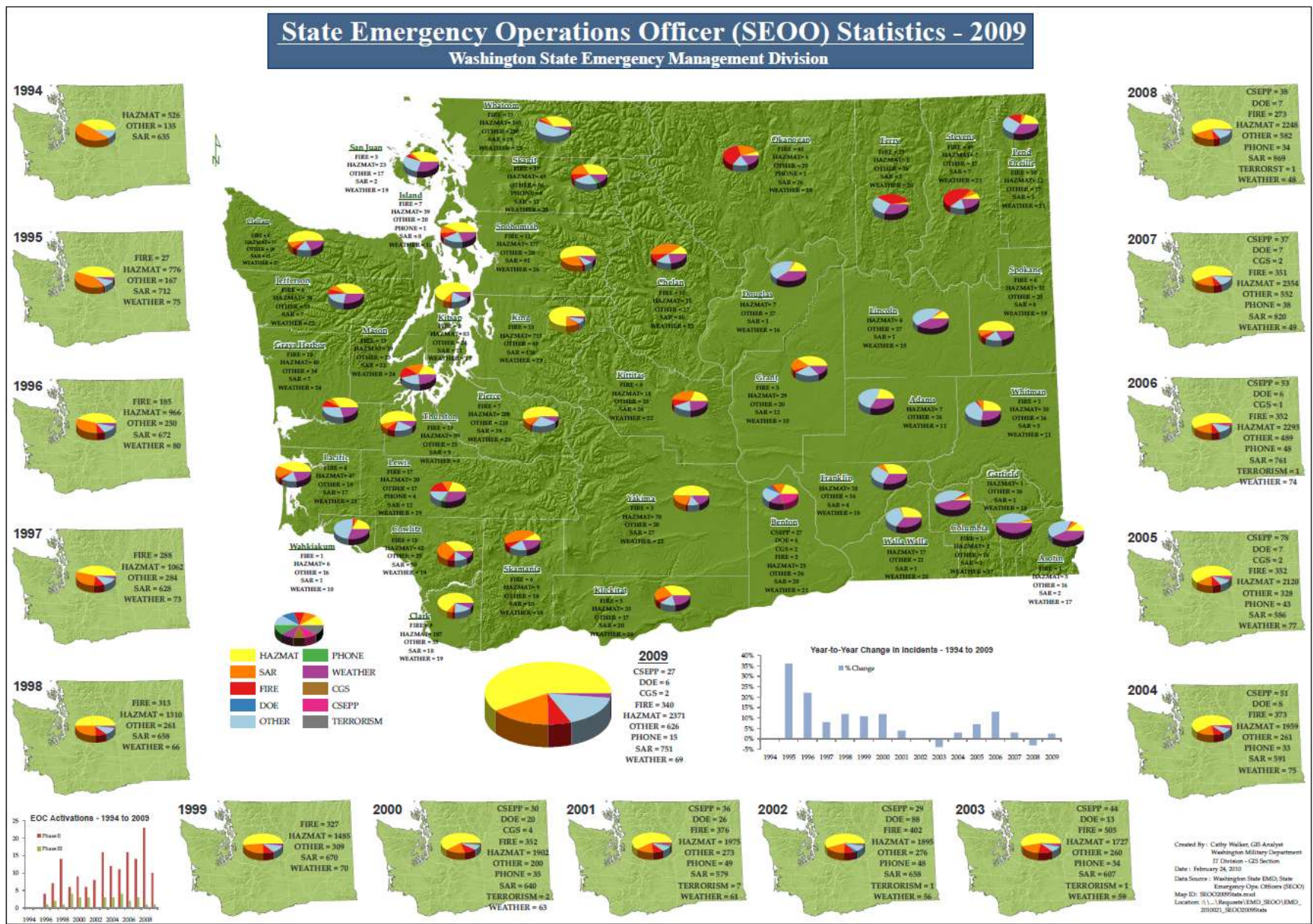
Five plans addressed dam failure, a new profile for the state's 2010 Plan edition. King, Okanogan, and Stevens Counties categorized their vulnerability as high to the impacts of a dam or levee failure, while Pacific County categorized their vulnerability as low. Lewis County indicated their vulnerability would depend on the situation, providing no categorical ranking.

Climate change is also becoming more common within mitigation plans. Some plans include hazmat, terrorism/cyber-terrorism, loss of utilities, transportation incidents, and civil disorder.

One of the man-made / technological hazard which appears in nine of the local plans is hazardous materials spills. Interestingly, the State has recorded 2,371 calls for service for hazmat incidents during 2009 alone. Every county statewide has experienced multiple instances of some form of hazmat incident within their jurisdiction as evidenced on the map below.

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2008 Plan Recommendations and 2010 Status of those Recommendations:

- **2008 Recommendation:** Drop avalanche and drought from the state plan's risk assessment; they will remain hazards addressed in the *Washington State Hazard Identification and Vulnerability Assessment* when it is updated in 2006. State and local jurisdictions have little infrastructure and few people vulnerable to avalanche, with the exception of transportation corridors through mountain passes. Additionally, very few local plans addressed the hazard. Drought primarily is an economic hazard to agriculture and timber interests rather than a hazard that damages property and threatens human life; on the other hand, hazard mitigation grant programs fund projects that minimize or eliminate the threat to life and property. Like avalanche, few local plans addresses drought as a hazard of concern.

2010 Status and Recommendation: While the 2008 plan recommended that the avalanche profile be dropped from the plan, it was determined that the profile should remain in based on the following.

During a series of storms occurring within a few weeks of each other, (the first resulting the December 2008 Flooding Declaration and the 2nd resulting in the 2009 Severe Winter Storm Declaration), avalanches and flooding caused a series of road closures within the state which lasted for 8 days. Below is a recap of estimated losses as determined by the Washington State Department of Transportation as a result of these closures.

Exhibit ES-1: Summary of Statewide Freight-Related Economic Impacts from the 2007-2008 Closures of I-5 and I-90 (in \$ Millions)

| Type of Economic Impact | I-5 Closure | I-90 Closure | Total Impacts Due to Closures |
|---|-------------|--------------|-------------------------------|
| Total Lost Economic Output (\$ Million) | \$47.07 | \$27.89 | \$74.96 |
| Employment Loss (Estimated Job Loss for One Year Following the Closures) | 290 | 170 | 460 |
| State Tax Revenue Loss (\$ Million) | \$2.39 | \$1.42 | \$3.81 |
| Reduction in Personal Income (\$ Million) | \$14.55 | \$8.60 | \$23.15 |

Source: WSDOT Freight Systems Division IMPLAN Modeling, 2008

Available at: <http://www.wsdot.wa.gov/research/reports/fullreports/708.1.pdf>

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Based on these losses, it was determined that a more progressive approach is needed to help mitigate the impacts of Avalanches on our state, and therefore, the profile is still included within the 2010 plan edition.

With respect to the drought profile, the state currently has five counties in Eastern Washington who are developing plans for the first time. As the risk resulting from a drought more severely impact jurisdictions in Eastern Washington, which have a large amount of agricultural/farming businesses, until such time as the new local plans are reviewed to determine their level of vulnerability to drought, the profile will remain in the State's plan. If, after review of the new plans, it is determined that drought carries a low vulnerability, the profile will be removed from the 2013 edition of the State's plan.

- 2008 Recommendation: Make only minor changes as necessary to update the criteria used to determine most vulnerable counties for the earthquake, flood and landslide hazards.
2010 Status: Completed as recommended.
- 2008 Recommendation: For severe storms, reduce the vulnerability assessment in the state plan to two storm types, high winds and winter storm. These storm types are of greatest concern to local planning jurisdictions and have the highest rate of occurrence. Reducing the state's assessment to two severe storm types will simplify the state plan's risk assessment for the hazard. Eliminated from assessment will be storm types such as tornado and severe thunderstorm, which occur less frequently and pose less threat, in general, to life and property.
2010 Status: Maintained focus on the two storm types: high winds and winter storms. While some of the local jurisdictions have included additional storm types, these two remained the primary focus.
- 2008 Recommendation: Incorporate ash fall into the state's vulnerability assessment for the volcano hazard. The assessment of counties most vulnerable to this hazard should include those jurisdictions whose annual probability of receiving 1 centimeter of ash fall from any major Cascade volcano in any year is 0.2 percent (1 in 500 probability of occurrence).
2010 Status: While ash fall was included in the Volcano profile for jurisdictions most susceptible during the 2010 update, this profile was not reviewed and updated in great detail. This is due to the fact that Washington State DNR and USGS, during the next update cycle, will be conducting significant research on this hazard, and it is felt that to devote a large amount of time at this point would not be time wisely spent as the potential exists for a large portion of the profile change during the 2010-2013 update cycle. It was felt that time would be better served to modestly update the profile with a new map and include ashfall to counties most likely impacted, but to not focus on a total review of the profile based on new data forthcoming.

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- 2008 Recommendation: Make no change in the assessment for counties most vulnerable to the wildland fire hazard. The assessment already uses a national-standard methodology used by all states for purposes of identifying local jurisdictions at risk to wildland fire for purposes of the National Fire Plan.
2010 Status: Utilized same methodology for determining county assessments.
- 2008 Recommendation: Include hazardous materials spill in the state plan's risk assessment, as there is considerable local interest in this hazard, as shown in approved local plans.
2010 Status: Hazardous Materials is a new hazard included in the State's plan during this update cycle.
- 2008 Recommendation: Prepare hazard profiles for all other man-made and technological hazards for inclusion of an updated *Washington State Hazard Identification and Vulnerability Assessment* (HIVA) as well as consideration for inclusion in the *2007 Washington State Enhanced Hazard Mitigation Plan*.
2010 Status: The State's HIVA was completed September 2009, and includes man-made and technological hazards. The 2010 edition of the SHMP also includes profiles for four new man-made and technological hazards: Hazardous Materials, Climate Change, Public Health and Dam Safety.

Conclusions and 2010 Recommendations:

As stated previously, the state hazard mitigation plan's determination of counties most vulnerable to various natural hazards generally correlated with the local plans' determination of vulnerability.

For the upcoming revision of the state plan, the following actions are recommended:

- Assess the need to drop avalanche and drought from the state plan's risk assessment; they will remain hazards addressed in the *Washington State Hazard Identification and Vulnerability Assessment*. State and local jurisdictions have little infrastructure and few people vulnerable to avalanche, with the exception of transportation corridors through mountain passes. Additionally, very few local plans addressed the hazard. Drought primarily is an economic hazard to agriculture and timber interests rather than a hazard that damages property and threatens human life; on the other hand, hazard mitigation grant programs fund projects that minimize or eliminate the threat to life and property. Like avalanche, few local plans addresses drought as a hazard of concern.
- Make only minor changes as necessary to update the criteria used to determine most vulnerable counties for the earthquake, flood and landslide hazards.
- Incorporate ash fall into the state's vulnerability assessment for the volcano hazard. The assessment of counties most vulnerable to this hazard should

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include those jurisdictions whose annual probability of receiving 1 centimeter of ash fall from any major Cascade volcano in any year is 0.2 percent (1 in 500 probability of occurrence).

- Make no change in the assessment for counties most vulnerable to the wildland fire hazard. The assessment already uses a national-standard methodology used by all states for purposes of identifying local jurisdictions at risk to wildland fire for purposes of the National Fire Plan.
- Enhance the profile for Climate Change to capture more of the information from the local plans. During the 2010 update process, a few jurisdictions had addressed Climate Change within their mitigation plans. The profile should be reviewed to include more specific information if warranted.
- Prepare hazard profiles within the SHMAP for any other man-made and technological hazards which appear with frequency in the local jurisdictions' plans.
- Continue working on a method of Risk Assessment which can be utilized within the local jurisdiction plans.
- Develop a method of capturing the strategies of the local jurisdictions for inclusion within the State's plan. The focus of these strategies should be to geared towards those strategies which are significant in nature, not generic or overly broad.

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| Jurisdiction | Earthquake | Flood | Severe Storms | Tsunami, Seiche | Wildland or Urban Interface Fire | Volcano | Landslide | Other | Loss Estimates Included ** / *** |
|--------------|------------|-------|---------------|-----------------|----------------------------------|---------|-----------|--|----------------------------------|
| Benton | | H | H | | H | | | | N |
| Chelan | M | H | H | | H | L | M | Avalanche, Drought - H | N |
| Clallam | M | H | M | | M | M | H | Drought - M | N |
| Clark | H | M | M | | M | L | M | HazMat - M; Terrorism - L | P |
| Cowlitz | H | H | H | L | M | M | M | Drought, Infestation/ Disease - L | N |
| Douglas | M | H | H | | H | L | M | Drought, Loss of Electrical - H; HazMat, Loss of Water - M | N |
| Ferry | | H | H | | H | | M | | N |
| Franklin | M | M | M | | M | M | M | Drought - M | C |
| Grant | L | L | M | | M | L | L | High Winds - H; Drought - M | C |
| Grays Harbor | H | H | H | H | M | M | M | | C |
| Island | H | H | M | H | H | L | H | Drought - Low | N |
| Jefferson | H | L | H | H | H | L | H | Drought - M | C |
| King | H | H | H | M | M | | H | HazMat, Transportation, Drought, Terrorism, Civil Disorder, Avalanche, Cyberterrorism - M; Dam Failure - H | C |
| Kitsap | H | H | H | M | M | | H | Drought - M | C |

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| Jurisdiction | Earthquake | Flood | Severe Storms | Tsunami, Seiche | Wildland or Urban Interface Fire | Volcano | Landslide | Other | Loss Estimates Included ** / *** |
|------------------------------|------------|-------|---------------|-----------------|----------------------------------|---------|-----------|--|----------------------------------|
| Lewis | H | H | M | | L | H | H | Dam/Levee Failure - Dependant on initial hazard | C |
| Mason | H | H | H | L | M | L | H | Drought - H | N |
| Okanogan | H | M | H | | H | M | M | Dam Failure - H; HazMat, Terrorism/Civil Unrest - M; Avalanche - L | C |
| Pacific | M | M | M | M | M | | | HazMat - M; Dam Failure - L | C |
| Pend Oreille | M | | H | | H | | M | Drought, Avalanche - M; Tornado - L | C |
| Pierce Phase 1 Region 5 Plan | M | M | L | L | L | L | L | | C |
| San Juan | | | | | | | | | |
| Skagit | H | H | M | L | H | M | M | Drought - L | P |
| Snohomish | H | H | H | L | M | L | M | | N |
| Spokane | M | M | M | | H | M | L | Drought, Terrorism, Civil Disturbance - M; HazMat - H | P |
| Stevens | H | M | M | | H | L | M | Pandemic, Dam Failure - H; HazMat, Terrorism/Civil Unrest - M | C |
| Thurston | H | H | H | | M | L | M | | C |
| Wahkiakum | M | H | L | | H | L | H | Drought - L | N |

Analysis of Local Hazard Vulnerability

| Jurisdiction | Earthquake | Flood | Severe Storms | Tsunami, Seiche | Wildland or Urban Interface Fire | Volcano | Landslide | Other | Loss Estimates Included ** / *** |
|--------------|------------|-------|---------------|-----------------|----------------------------------|---------|-----------|-------------|----------------------------------|
| Walla Walla | M | L | M | | M | | | | N |
| Whitman | M | H | H | | M | L | | Drought - L | P |
| Whatcom | H | H | | H | H | H | H | HazMat - H | N |
| Yakima | L | M | H | | M | L | L | HazMat - L | N |

Notes

*Vulnerability listed in table is as categorized by local plans as of January 31, 2010. Unless otherwise described in table or noted below, vulnerability to hazards is categorized as High (H), Medium / Moderate (M), or Low (L). If vulnerability to a hazard is rated as "low to moderate" for example, the higher rating ("moderate") was used in table above. No rating is listed for hazards which are not categorized. If the jurisdiction utilized a numerical system of categorizing their plans, those rankings were transferred to the High/Moderate/Low scale based on the following: 0-3.0 = Low; 3.1-6.5 = Moderate; 6.5-10.0 = High. For those county plans which were multi-jurisdictional, only the overall county data was captured, and not each jurisdiction covered within the plan. For jurisdictions currently in the planning process, data from previously approved plan was utilized.

**In the loss estimates included column, the values are complete (C), partial (P), or none (N).

***Of significant importance is the method jurisdictions utilized to conduct their risk assessment estimating dollar losses. Some jurisdictions utilized 100% of the county area to determine losses when in fact 100% of the jurisdiction was not impacted. While the number of plans including a loss estimation has increased, the accuracy of those dollar figures is significantly skewed and cannot be relied upon.

Counties with Plans under development as of January 31, 2010 are: Asotin, Benton, Chelan, Clallam, Columbia, Cowlitz, Douglas, Ferry, Franklin, Garfield, Grays Harbor, Jefferson, King (jurisdictions), Kitsap, Kittitas, Lewis, Lincoln, Mason, Pacific, Pierce County Phase 2, Pend Oreille, Skamania, Snohomish, Spokane, Thurston, Walla Walla, and Yakima.

Tribal Plans under development as of January 31, 2009: James Town Port S'Klallam, Makah, Lummi, Tulalip, Lower Elwha Klallam, Nooksak, Puyallup, and Nisqually.

Cities with plans under development as of January 31, 2010 are: Auburn, Hoquiam, Cheney, Kent, Mukilteo, Puyallup, Snoqualmie, Federal Way, Redmond, and Everett.

Jurisdictions without planning initiatives underway as of January 31, 2010 are: Adams, Clark (expired 12/16/09 - unsure if they will pursue plan update), and Klickitat Counties;

Analysis of Local Hazard Vulnerability

| Footnotes |
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| Benton County Hazard Mitigation Plan has six participating local jurisdictions. Plan categorizes three hazards as priority with high probability of occurring within the next five years, and defines vulnerability by area of the city within the plan narrative; probability of occurrence within the next five years is listed in the table above. |
| Chelan County Plan has six participating local jurisdictions. Hazards are categorized by probability of recurrence. |
| Clallam County Plan has eight participating local jurisdictions. |
| Clark County Plan has eight participating local jurisdictions. Hazards are categorized by risk. (Plan is currently expired; jurisdiction is working on update. |
| Cowlitz County Plan has 27 participating local jurisdictions. |
| Douglas County Plan has seven participating local jurisdictions. Each jurisdiction rated vulnerability to hazards based on a number of criteria. Ranking in table above is summary of risk covering all planning jurisdictions. Where a hazard received a multiple ratings, the majority rating was used (i.e., if a hazard was rated "high" by four or more jurisdictions, the rating in the table is listed as "high"). Where there was no majority rating for a hazard, the ratings were averaged for the listing appearing in the table above. |
| Ferry County Plan has four participating local jurisdictions. The Plan categorizes hazards by likelihood of recurrence. |
| Franklin County Plan has 12 participating local jurisdictions. Plan categorizes hazards by probability of occurrence and risk to people and the built environment. Hazards are categorized by risk. |
| Grant County Plan has 33 participating local jurisdictions. |
| Grays Harbor County Plan ranked hazards based on likelihood of occurrence and impacts on people and the build environment. The hazards were scored out of 12 possible points, and were adjusted to fall within the State 10-point scale used above. |
| Island County Plan has eleven participating local jurisdictions. The Plan categorizes hazards by probability of occurrence and impact. The table above lists the rating for hazard impacts. |
| Jefferson County Plan includes 19 participating local jurisdictions. Plan ranks risk and vulnerability to hazards from very high to very low. |
| King County Plan previously included 37 participating local jurisdictions. Because of issues surrounding Howard Hanson Dam and a potential dam breach, the County first completed the County's base plan, and is in the process of adding on the remaining jurisdictions. The plan categorizes hazards by probability of occurrence and impact (i.e., (high probability, moderate impact"). The table above lists the rating for hazard impacts. |
| Kitsap County Plan includes 36 participating local jurisdictions. The plan categorizes hazards by probability of occurrence, and each participating jurisdiction provides a priority ranking of hazards. The rating in the table uses the average priority ranking of hazards. |
| Lewis County Plan includes 47 participating local jurisdictions. |
| Mason County Plan includes six participating local jurisdictions. Plan lists hazards most threatening to participating local jurisdictions. |

Analysis of Local Hazard Vulnerability

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|---|
| North King / South Snohomish Plans include 10 participating local jurisdictions. Each jurisdiction rated vulnerability to hazards based on a number of criteria. Ranking in table above is probability of occurrence on regional basis covering all planning jurisdictions; where a hazard included multiple ratings, the higher rating was used in the table above. |
| Okanogan County Plan includes 23 participating local jurisdictions. Table lists the top five hazards as identified in the plan, based on composite scores developed by participating jurisdictions. |
| Pend Oreille County Plan includes 11 participating local jurisdictions. Table lists the top five hazards as identified in the plan, based on composite scores developed by participating jurisdictions. |
| Pierce County Region 5 Plan includes 48 participating local jurisdictions. |
| Skagit County plan includes 13 participating local jurisdictions approved as of 1/31/10. |
| Snohomish County Plan has 42 participating local jurisdictions. All jurisdictions individually rank hazards by priority based on projected estimated loss and probability of occurrence. The rating in the table uses the average priority ranking of hazards. |
| Spokane County plan includes 3 participating local jurisdictions. |
| Stevens County plan includes 15 participating local jurisdictions. |
| Thurston County Plan includes 26 total participating local jurisdictions, only 8 of which have adopted the plan to date. The plan addresses three hazards that have a high probability of occurring within 25 years, have a high potential for significant damage to the built environment and for loss of life; these hazards are listed as “high” in the table above. |
| Wahkiakum County Plan is a single jurisdiction plan. |
| Walla Walla County Plan includes six participating local jurisdictions. Plan addresses five hazards, whose risk rating appears in the table above. |
| Whatcom County Plan included nine participating local jurisdictions. Plan identifies six hazards as “specifically hazardous to the populated western areas of Whatcom County.” They are identified in the table above with a “high” designation. |
| Whitman County Plan has 21 participating local jurisdictions. |
| Yakima County Plan includes 25 participating local jurisdictions. Each jurisdiction rated vulnerability to hazards individually based on a number of criteria. The plan identified 54 hazards / hazard agents to which the county and its jurisdiction is vulnerable; those that pose the greatest threat to people are rated as “high” in the table above. |